IN THE SPECIFICATION

Please delete the heading and paragraph beginning at page 1, line 1, as follows:

~~SPECIFICATION~~

~~TO ALL WHOM IT MAY CONCERN:~~

~~BE IT KNOWN THAT WE, OSAMU NARUSE, a citizen of Japan residing at Kanagawa, Japan, TOHRU NAKANO, a citizen of Japan residing at Kanagawa, Japan and MASANORI HORIKE, a citizen of Japan residing at Kanagawa, Japan have invented certain new and useful improvements in~~

Please insert the following heading at page 1, before the title:

TITLE OF THE INVENTION

Please delete the paragraph at page 1, following the title, as follows:

~~of which the following is a specification:~~

Please replace the paragraph beginning at page 3, line 11, with the following rewritten paragraph:

In addition, a higher image quality can be obtained the more the diameter of toner particles is reduced, and the more the shape of the toner particles becomes a sphere. Therefore, development and the market are directed toward providing toner particles with smaller diameters and with shapes closer to a sphere. Nevertheless, as the diameters of the toner particles become smaller and as the shapes of the toner particles become closer to a sphere, cleaning tends to become more difficult. More specifically, after a toner image is transferred to a target transfer body, it is difficult to sufficiently remove toner remaining on

the surface of the image carrier, and thereby results [[to]] in poor cleaning performance. Since toner, being situated at a contacting part between the image carrier and the cleaning blade, is more or less near a closest packed state during cleaning with a blade cleaning method, a first layer of toner, which is situated toward the image carrier side and which firmly adheres to the image carrier, slides against a second layer of toner situated above the first layer of toner, thereby causing the toner of the first layer to remain on the image carrier and resulting in poor cleaning performance.

Please replace the paragraph beginning at page 4, line 9, with the following rewritten paragraph:

In order to solve the foregoing problems, measures are taken for the cleaning blade method, for example, by increasing the degree of hardness of rubber and contact pressure of the blade. These, however, promote the wear of the image carrier and accelerate the wear of the rubber of the blade, thereby shortening the longevity of the cleaning blade.

Please replace the paragraph beginning at page 6, line 23, with the following rewritten paragraph:

Furthermore, a cleaning method of applying ~~vibration~~ vibrations to a cleaning blade is proposed in response to toners that are formed in smaller sizes and with more roundness. This method, however, faces a problem of wearing of the cleaning blade at a portion that rubs against the image carrier. Since the cleaning blade has less hardness than the image carrier, the cleaning blade wears faster than the image carrier, and has a shorter longevity than the image carrier.

Please replace the paragraph beginning at page 20, line 8, with the following rewritten paragraph:

With the cleaning apparatus according to the first embodiment, the blade chip 14 can be easily detached and replaced since the blade member 12 and the reinforcing plate member 13 are joined (e.g. by adhesive attachment), to thereby form a united body, that is, a blade chip. For example, in a case where the blade member 12 has a length 300 mm through 360 mm, a thickness of 0.3 mm through 1 mm, and a width of 10 mm, the blade member 12 of the blade chip 14, even when detached, can maintain its elongated plate structure without being bent or broken since the blade member 12 is joined to the reinforcing plate member 13. Accordingly, the cleaning apparatus can be handled with ~~lesser~~ less care, that is, with more ease. Furthermore, since the shape of the blade chip 14 can be maintained during a procedure of flipping, re-attaching, and/or replacing the blade chip 14, the blade chip 14 can be easily attached.

Please replace the paragraph beginning at page 24, line 12, with the following rewritten paragraph:

Here, cleaning performance was graded and categorized into five levels by cleaning the image carrier drum 2 with the blade member 22 while altering the proportion between the degree of projection (L) and the thickness of the blade member (T1). According to the cleaning results as shown in Fig.5, the resultant relation between the degree of projection of the blade member 22 and cleaning performance shows that cleaning performance becomes lower as the degree of projection L increases. Therefore, in a case where no proportional relation between the degree of projection (L) of the blade member 22 and the thickness (T1) of the blade member 22 is satisfied, that is, where the degree of projection (L) is 0, the cleaning level is graded as the highest level of 5, as indicated by the scale corresponding to 0

on the horizontal axis in Fig.5. In a case where the degree of projection (L) is the same as the thickness (T1) of the blade member 22, the cleaning level is graded as being in-between level 4 and level 5, as indicated by the scale corresponding to 1 on the horizontal axis in Fig.5. More particularly, according to the results, it is found that cleaning performance decreases considerably because the rigidity (e.g. rigidity of rubber) becomes smaller and forming the blockage becomes more difficult when the degree of projection (L) is equal to or more than the thickness (T1) of the blade member 22. In addition, it is found that problems, such as curling up of the blade, tend to occur when the degree of projection (L) becomes excessively large.

Please replace the paragraph beginning at page 25, line 16, with the following rewritten paragraph:

Therefore, the blade chip 21 according to the second embodiment of the present invention is provided with the blade member 22 having an entire face thereof bonded to the entire face of the reinforcing plate member 13 and having [[the]] a degree of projection that is 0 or no more than the thickness T1 of the blade member 22. That is, according to the second embodiment of the present invention, the degree of projection L of the blade member 22 is set to be the same as the thickness (T1) of the blade member 22 as shown in Fig.4.

Please replace the paragraph beginning at page 28, line 3, with the following rewritten paragraph:

Furthermore, the vibration reduces the friction between the blade edge and the image carrier drum 2, to thereby reduce the frictional force of the sliding contact upon the blade member 22. Here, the rotational torque of the image carrier drum 2 was measured in a case where the blade member 22 is applied with and without vibration. According to the results

shown in Fig.7, it is found that in a case where vibration is applied to the blade member 22, the rotational torque of the image carrier drum 2 is approximately 30 to 50% lower compared to a case where no vibration is applied to the blade member 22. Furthermore, as shown in Fig.7, the rotational torque when a vibration is applied has a tendency of gradually increasing as the rotational speed of the image carrier drum increases from 0 to V5. The rotational torque when no vibration is applied has a tendency of decreasing from T5 to the proximity of T3, but will not decrease to the level of the rotational torque of the blade member applied with vibration. That is, it is found that a significantly reduced rotational torque can be obtained by applying vibration to the blade member 22 even when the image carrier drum 2 is rotated at maximum speed V5. This is due to the fact that the torque load from the friction generated between the blade member 22 and the image carrier drum 2 is reduced. Accordingly, it is found that the longevity of the blade member (blade chip) can be expanded considerably by applying a vibration to the blade member. That is, since frictional force can be reduced in such manner, the wear of the blade member 22 caused by frictional force can be reduced.

Please replace the paragraph beginning at page 29, line 9, with the following rewritten paragraph:

With the cleaning apparatus 25 according to the third embodiment of the present invention, the frictional force generated between the blade member 22 and the image carrier drum 2 can be reduced by applying vibration to the blade chip 21 (blade member 22). Accordingly, the wear of the blade member 22 as well as that of the image carrier drum 2 can be reduced, to thereby expand its longevity. Furthermore, since frictional force is reduced in such manner, the curling of the blade (member) can be prevented. Therefore, the blade edge (distal end shape of the blade member 22) can be prevented from being deformed.

Accordingly, the blade member 22 is able to steadily provide a satisfactory cleaning performance. Furthermore, the image carrier drum 2 can be rotatively driven steadily since the frictional load applied to the image carrier drum 2 is reduced. Accordingly, image forming operations that are associated with the rotation of the image carrier drum 2 can also be performed steadily. As a result, image quality can be improved.

Please replace the paragraph beginning at page 30, line 16, with the following rewritten paragraph:

That is, at least the contacting portions of the blade member 32 (lower left and lower right portions of the blade member 32 in Fig.8)~~, that is~~. More particularly, the blade edge portion A and the blade edge portion B (Fig.3) are partly or entirely subjected to modification (surface processing). As a conventional example of surface processing for reducing the frictional coefficient, there is a technique (method) of coating with an activated powder of graphite or molybdenum disulfide. However, such coating technique has a problem of poor endurance in which the coated activated powder peels along with the passing of time.

Please replace the paragraph beginning at page 37, line 23, with the following rewritten paragraph:

Accordingly, with the cleaning apparatus 40 according to the sixth embodiment of the present invention, vibration can be satisfactorily propagated by setting the thickness of the vibration plate thinner than that of the reinforcing plate member 13, and that of the blade member 22. That is, since the vibration plate 41 is allowed to easily change shape by setting the thickness of the vibration plate less than that of the reinforcing plate member 13 and that of the blade member 22, vibration energy consumed in the changing of shape can be reduced, thereby enabling ~~vibration~~ vibrations to be propagated more effectively and efficiently.

Accordingly, the ~~vibration~~ vibrations from the piezoelectric element 27 can be efficiently propagated to the blade member 22. As a result, the energy consumed by the piezoelectric element 27, (vibration source) can be reduced. Accordingly, energy can be saved. Furthermore, since the vibration output of the piezoelectric element 27 can be reduced, the piezoelectric element 27 can be formed with less size and weight. Furthermore, manufacturing cost, for example, can be reduced since the output of the piezoelectric element 27 can be reduced.

Please replace the paragraph beginning at page 39, line 5, with the following rewritten paragraph:

In the cleaning apparatus 45, notch portions 47, which are formed by notching the vibration plate 46 into substantially rectangular shapes, are disposed between the vibration plates 46 in a direction where a plurality of piezoelectric elements 27 are aligned in a longitudinal direction of the vibration plate 46. Accordingly, by reducing the section modulus of the vibration plate 46 serving as a beam, a more flexible structure is obtained. That is, since the piezoelectric elements 27 of the vibration plate 46 are disposed as a bridge-like beam extending from the proximal end to the distal end of the vibration plate 46, the section modulus is reduced. Therefore, ~~vibration~~ vibrations from the proximal end of the vibration plate 46 can be propagated more efficiently to blade chip 27 disposed at the distal end of the vibration plate 46.

Please replace the paragraph beginning at page 40, line 3, with the following rewritten paragraph:

With the cleaning apparatus 45 according to the seventh embodiment of the present invention, the vibration plate 46 becomes easier to bend and vibrate by forming notches in

portions of the vibration plate 46. Therefore, kinetic energy required for vibrating the vibration plate 46 can be reduced. Therefore, the energy consumption (drive voltage) of the piezoelectric elements 27 can be reduced, to thereby save power.

Please replace the paragraph beginning at page 41, line 3, with the following rewritten paragraph:

As described above, taking factors such as vibration propagation and flexibility into account, a metal material is, for example, employed as the material of the vibration plate 46. Furthermore, taking factors such as shape stability and endurance against the environment into account, a polyurethane rubber is, for example, employed as the material of the blade member 22.

Please replace the paragraph beginning at page 41, line 10, with the following rewritten paragraph:

In a case where vibration is propagated from the vibration plate 46 (vibration source) to the blade member 22 (e.g., made from synthetic rubber) via the reinforcing plate member 13 (e.g., made of metal material), a large difference in acoustic resistance (pc) is created between the reinforcing plate member 13 and the blade member 22. Accordingly, a vibration is attenuated considerably when vibration is propagated from the reinforcing plate member 13 having a large acoustic resistance to the blade member 22 having a small acoustic resistance. Here, p indicates density, and c indicates acoustic resistance of material. In a conventional example, the value of acoustic resistance ($g/s/cm^2$) of the reinforcing plate member 13 and the blade member 22 are indicated as below.